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PHARMACOGNOSY AND THE UNITED STATES PHARMACOPŒIA.*

By Henry Kraemer.

Pharmacognosy in both the modern acceptation and application of the term is a comparatively new department of science, although the history of the use of vegetable drugs is as old as that of medicine itself. While we have been accustomed to look upon pharmacognosy as a division of botany, it has so expanded within the past twenty-five years as properly to be regarded as a distinct branch of science. As in bacteriology the problems in the study of bacteria are different from those of the botanist, so in pharmacognosy the problems differ from those in pure botany, being on the one hand similar to those which are considered by the modern agriculturist. In other words, pharmacognosy involves not only a study of botany, including morphology and anatomy, but also studies in chemistry, including both plant chemistry (phyto-chemistry) and drug chemistry (pharmaco-chemistry). The pharmacognosist is not merely concerned with the dried drug as he sees it, but also with those conditions which influence the development of the constituents of the plant or which modify those constituents in the drug on which medicinal activity depends. Indeed the subject is a very broad one and a very complicated one when viewed from all sides, and it is a long way from the living plant from which the drug is derived to the laboratory of the pharmacist who makes the preparation. There

* Read before the City of Washington Branch of the American Pharmaceutical Association, January 5, 1910.

are problems at every point in the ofttimes circuitous route which the drug travels before reaching its final destination in the finished preparation. In addition to the field problems, as those involving the determination of the identity of the plants and variation in the constituents at different seasons of the year, there are also other factors of which cognizance must be taken that influence the quality and appearance of vegetable drugs, as the degree of skill used in the drying and curing of the drugs; the proportion of other plant parts, as of stems attached to roots; the manner and length of time of keeping; and attacks of fungi and insects, etc. We may say, therefore, that pharmacognosy begins with the study of the plants yielding vegetable drugs and ends with the determination not alone of their identity but of their quality also.

When one considers that about 70 per cent. of the articles included in the Pharmacopœia are vegetable drugs, their constituents, or their preparations, it is seen that the users of the Pharmacopœia must have a knowledge of pharmacognosy, and that the physician is directly dependent upon the work of the pharmacognosist for the therapeutic efficiency of many of the most important medicines which he prescribes. It matters not how perfect the methods for making preparations are if the materials used in their preparation are spurious, worthless, or vary in quality to a considerable extent. There is no doubt that many useful drugs and their preparations have become and are becoming obsolete for the reason that other drugs which are inert or have different properties have been or are being substituted for them. Such a condition not only baffles the efforts of the therapeutist but also tends to deprive him of remedies which heretofore were considered to have certain valuable properties. But some will say that the drugs are becoming scarce. This is true in some instances, but instead of simplifying the question, renders it more complicated in that the necessity arises for detecting the spurious substitutes that are frequently admixed with the genuine drug or even entirely replace it.

THE U. S. PHARMACOPŒIA.

While it is not possible to consider all the various phases of pharmacognosy in the Pharmacopœia, it is desirable to give definitions and descriptions of the official vegetable drugs which are adequate for the establishment of their identity and efficiency. In other words, it is the results of the studies in applied pharmacog-

nosy which should be included in the Pharmacopœia, leaving the problems and studies in pure pharmacognosy for the text-books and reference books.

That part of the U. S. Pharmacopœia VIII devoted to pharmacognosy is not only not abreast with the other departments of this work, but, furthermore, when this part is compared with that in the foreign pharmacopœias it is found to be lacking in important particulars. This would lead to the conclusion that we in this country not only do not recognize the importance of the subject but that we are more or less indifferent to the nature of the drugs which we employ. That this condition, or worse, still prevails, is shown by the expressed desire to eliminate standards for crude drugs. It has been proposed to permit all grades of crude drugs to be admitted to this country and to be sold and used in the making of galenicals, the only provision suggested being that the finished preparations shall be standardized. Apart from the many objections that can be raised against such a procedure, as, for example, the inadequacy of the assay processes themselves to confirm the identity of the drug on the one hand or its full medicinal value on the other, there are other practical difficulties in the way. To illustrate, Dr. J. M. Francis states in commenting on the results of his assay of many thousands of pounds of belladonna root of the market, that, " While theoretically an increased quantity of poor drug will make a good fluidextract, if the latter be standardized by assay, there are, however, practical objections to using an excessive quantity of drug, as the fluid will be highly charged with extractive matter and will not keep well."

On the face of it, it is not reasonable to suppose or believe that a good fluidextract or tincture can be made from a poor drug any more than to suppose that good malt can be prepared from barley grains of poor quality or a good extract of beef from meat of poor quality. It is true that a certain amount of alkaloid may be extracted in some instances from a mouldy, wormy, or otherwise inferior drug, but no one would contend that in the majority of cases the medicinal properties of a tincture, fluidextract, or infusion are wholly dependent upon the percentage of one such principle alone or that the preparations would be as good in other respects as those made from drugs of good quality. If, however, this be contended, then the better procedure would be to use the alkaloids and other isolated principles themselves. Discussing this question in a recent

paper Tschirch[1] writes: "For when the isolated substances are tested pharmacologically, it becomes evident that their action does not correspond with that of the drug itself—for the latter scarcely ever contains a single active constituent but frequently a remarkable mixture of substances that are often antagonistic in their effects. I will refer only to rhubarb, which, in addition to laxative anthraglucosides, contains astringent tannoglucosides, and owes its therapeutical use to the simultaneous occurrence of these two antagonistic groups of substances. Although, unable to free ourselves from the views of Galen, drugs are still called 'simples,' they are in reality far from simple; indeed they are extraordinarily complex substances."

Again, Turner in a recent paper[2] has called attention to some of the newer views in regard to the components of drugs on which medicinal activity depends and to a tendency to abandon the idea that the principles separated by assay truly represent the value of the drug. He says: "Boulanger-Dausse in *Bulletin des Sciences Pharm.*, No. 1, 1908, pays particular attention to this question and comes to the following conclusions:

"The endeavor to isolate the 'alkaloid' to which scientific pharmacy paid such vivid attention for nearly one hundred years begins to lose its practical significance. The chemistry of colloids partly takes its place and the chemist and pharmacologist pay more and more attention to certain complex ingredients of drugs, or, as they are usually called, 'extractives' of drugs.

"A diligent and successful investigation of certain drugs showed conclusively that the active principles isolated from them in the course of one hundred years and studied both chemically and pharmacologically did not satisfy the requirements which the physician had right to put to them. Cinchona, digitalis, ergot, rhubarb, buckthorn, cascara sagrada, kola, opium and nux vomica are the best examples illustrating what was said before.

"Many prominent pharmaceutic chemists and, lately, especially Kunz-Krause, recognized this in proper time and showed that in many cases the production of chemically pure active principles of drugs can no longer be the ultimate purpose of pharmacy. It is more proper to expect that in the future pharmaceutical science will direct its work toward production of chemically unchanged colloidal

[1] *Pharm. Jour.* (London), **83**, 420, October, 1909.

[2] Am. Jour. Pharm., **81**, 125, March, 1909.

drug preparations which will have the *total* action of the respective drug."

At any rate, we have not advanced to that point where we know or can isolate the active constituents in all cases, or where we are willing to say in those cases where certain active constituents have been isolated that they represent the full medicinal value of the drug and could replace the preparations. Hence it cannot be gainsaid that there is an urgent demand for accurate and adequate, if not full, pharmacognostic descriptions in the Pharmacopœia. With the introduction of standards for crude drugs which not only fix the percentage of certain active constituents but which assure their quality in other ways, preparations can be made by the pharmacist on which the physician can rely for their therapeutic efficiency.

It is not too much to claim that with every drug it is possible to indicate by adequate descriptions and if necessary by other tests than assays a standard quality which will insure uniformity, stability, and efficiency of the preparations into which the drug enters. If there is any class of articles included in the Pharmacopœia which requires a purity rubric it is the vegetable drugs, as they vary in medicinal activity from practically zero up to 99 per cent., the official drugs being in some instances entirely substituted by other drugs, or they are of varying degree of quality because of their age, or the conditions under which they have been kept, or because of the presence of a large excess of other parts of the plant than that designated as the drug, or because of foreign impurities. It would seem to be unnecessary to refer to this subject, as the principle is one so self-evident and fundamental to the observing pharmacist, as well as critical practitioner, who is studying the effects of drugs and their preparations on his patients. The manufacturers of specialties understand this, as do also some of the large manufacturing houses, and this is no doubt one of the reasons why their preparations are specified and will continue to be used by those physicians who are not trusting to luck or chance.

FOREIGN PHARMACOPŒIAS.

The importance of adequate pharmacognostic descriptions and tests appears to be recognized by the compilers of all the more recent foreign pharmacopœias that have come to my notice. The question with the revisers of these books seems to be not a matter of considering the pharmacist's ability or inability to apply the

required tests and use the knowledge given, but primarily to include such descriptions and tests as will insure the quality and genuineness of the articles both under vegetable drugs and medicinal chemicals. One does not go very far in the examination of these books without getting the idea that the pharmacist is expected to have the necessary books of reference, the apparatus, and the training which will enable him to use the pharmacopœia in determining the character of the products therein given. While some of these pharmacopœias do not include tests requiring special expensive pieces of apparatus as is required in our own Pharmacopœia, as in the tests involving the use of the polariscope, they all require the use of the microscope. In other words, the foreign pharmacopœias are more balanced in their treatment of the various subjects, and we would not be likely to hear the comment on a foreign pharmacopœia, as we have regarding our own standard, that it is a "chemist's book."

The treatment of vegetable drugs in the foreign pharmacopœias may be quite complete, as in the Netherlands Pharmacopœia, where a page or more is frequently given to each drug. Or it may be what would be termed adequate, the intention being that the user shall be familiar with the structure of the typical drug either from the study of the drug itself or the books of reference, as in the Swiss Pharmacopœia, the French Codex, the Pharmacopœia of Japan, and others. Besides, in a number of foreign pharmacopœias various constants are given, including percentage of ash, percentage of extractive, as also various special tests, some of these being microchemical. Generally speaking, the treatment of the microscopic structure is an essential feature of the descriptions, and may be of the crude drug alone, or more especially of the powdered or ground drug, or of both. In some of these pharmacopœias powdered drugs are not recognized or only occasionally referred to, probably from a recognition of the difficulty of identifying and determining the percentage of impurity or admixture, and also perhaps in view of the fact that very many drugs deteriorate or lose certain desirable properties when in the comminuted condition. As one goes through these pharmacopœias he is impressed by the fact that there are standards for vegetable drugs as there are for medicinal chemicals and the adequate descriptions and special tests correspond to the identity tests given for chemicals, and the revisers have availed themselves of the scientific progress that has been made in all lines touching their own work.

PHARMACOGNOSY AND COMMERCIAL DRUGS.

It appears to me to be unfortunate that the Committee on Drug Market of the A. Ph. A., representing as it does an association composed of the leaders in education and the scientific workers in pharmacy in this country, should have presented at the last annual meeting a report which tends to throw discredit upon practical or applied pharmacognosy in this country. This is the more to be deplored because of the fact that the Committee on Drug Market of the National Wholesale Druggists' Association incorporated the findings of the A. Ph. A. committee in its report presented at the Richmond meeting and also because the report has been commented upon and considered to represent an actual condition. The N. W. D. A. Committee cannot of course be blamed for accepting the findings of a committee of our leading scientific association. While I do not know who the experts were to whom specimens were submitted by the A. Ph. A. committee, I may say that I have in mind a recent graduate of a college of pharmacy who was able to take a drug like the one reported on by the A. Ph. A. committee and quantitatively separate the component drugs of the mixture. I do not mean to imply that this is a piece of off-hand work, but that it requires a certain amount of knowledge, training, and some patience; but on the other hand I do want to state that any one claiming to be trained in applied pharmacognosy should be able readily to make a differentiation of the component drugs of such a mixture as is referred to in the report of the committee of the A. Ph. A., and, furthermore, that the condition of the drug market creates the necessity for work of this kind. As a matter of fact, questions of this kind arise daily in the drug market, and it behooves us to frame the Pharmacopœia in such a manner as to make it a valuable aid and guide in this practical and all-important work, and warrants us in looking to the colleges of pharmacy to train their students in such a manner as to enable them to be useful in this particular field.

Such a report as that of the A. Ph. A. committee tends to hinder progress in that it leads importers and dealers to think that there is no way out of their difficulties, and, what is still more deplorable, leads those who engage in fraudulent practices to feel that there are probabilities that their practices will not be detected. Again, such reports tend to minimize the importance of the question in the eyes of dealers, and finally to cause delays in the progress of the sciences of both pharmacy and medicine.

However, we have a responsibility in these matters which we cannot evade, and the dealers in drugs look to us to study the conditions and the materials, and to furnish descriptions and tests for determining identity and establishing standards of quality which will be of practical assistance and which they can rely upon with as much certainty as their tests and standards for chemicals. There appears to me to be no reason why the whole subject of the purchase and sale of vegetable drugs should not at least be on as satisfactory a basis as that of spices. I have sufficient faith to believe that when the standards and tests for vegetable drugs are developed as they should be, or adopted even as we know them to-day, there will be no more quibbling about the difficulties of obtaining vegetable drugs of satisfactory quality than there is about medicinal chemicals at the present time, and that the dealers will be glad for the adoption of such standards. With the establishment of fair standards it will be possible for importers and wholesale dealers to insist that the garbling of drugs and the removal of extraneous matter shall be carried on by the collectors and distributors before they enter commerce. Such a procedure would be wholly in accordance with the modern way of handling problems of this kind. Why shall 40,000 druggists be worried about gross adulterations and admixtures when these can for the most part be detected at the point where the drugs enter commerce and where such pressure can be brought to bear upon the collectors abroad as well as in this country as will cause them to remedy deficiencies in their knowledge of the drugs or plants from which they are derived and prevent continued carelessness in their collection. I am satisfied that the lack of uniformity in the preparations of vegetable drugs at the present time, as shown both by chemical and pharmacological assay, is due to various factors not connected with plant growth, rather than to inherent variation in the drugs themselves, which usually only vary within certain narrow limits.

U. S. PHARMACOPŒIA IX.

It has been pointed out that in the commerce of drugs practical problems are continually arising, and hence the Pharmacopœia should contain such information as will help in the solution of these problems. That part of the U. S. Pharmacopœia devoted to pharmacognosy has not had a thorough revision since at least 1890, and with the progress that has been made in applied pharmacognosy

in that time, the necessity arises for a vast amount of work in bringing this part up to date and in making it a guide and standard for practical purposes.

In a previous paper [3] I pointed out some of the difficulties connected with revision work, particularly in this department. Soon after the Subcommittee on Pharmacognosy of the last revision began its work it became evident that it was not a question of developing the special work in hand or improving the Pharmacopœia, as it was of conducting a campaign of education showing the necessity for and importance of the work. While it remains to be seen what has been accomplished by this campaign of education, there can be no question as to what is required in the inspection and selection of drugs.

In order that the U. S. Pharmacopœia IX may not only be abreast of the times but also be a valuable guide and handbook, and at the same time a credit to the revisers as well as a source of pride to the physicians and pharmacists of this country, it is important in the first place that the Pharmacopœial Convention abstain from passing any resolutions which would tend to bind the hands of the Subcommittee on Pharmacognosy and prevent them from doing their best work. Tentative recommendations might be made by the Convention and referred to the subcommittee for their consideration and final decision, and these should be welcomed.

This leads me to say that the work of a subcommittee may not only be handicapped by binding resolutions adopted by the Convention but also by the giving of instructions by the Committee of Revision which tend to hinder the work. Here it may be pointed out that the Committee of Revision as a whole does not appear to me to be so constituted as to be any more capable of making binding recommendations on special subjects than the Convention itself. Therefore it is to be hoped that in the work of the next revision the subcommittees will be free to carry on the work to the best of their knowledge, experience, and ability, and for which they will be held responsible. In my previous paper, to which reference has already been made, I have discussed this matter at some length, and it will not be necessary to go into it further at this time. But after all, as I have elsewhere [4] stated, "it is not so much a matter of

[3] Am. Jour. Pharm., 80, 81, February, 1908.
[4] *Am. Dr.*, 55, 378, 1909.

method as it is of selecting men to carry on the work of revision who comprehend the scope and intent of a pharmacopœia," for even with the most perfect system there is yet a possibility that the best will not be attained.

In view of the large amount of work which the Subcommittee on Pharmacognosy will have to do in the next revision this committee should be increased and empowered to employ assistance for carrying on certain detail work. Of the subjects to which special consideration should be given, the following may be mentioned: the definitions both in relation to commercial varieties and botanic species, with the object of making them more exact and at the same time more easily understood; the microscopic structure of the drugs, with the view of aiding identification; special tests and standards for assisting in the determination of quality; and finally the question of the inclusion of powdered drugs with adequate descriptions and tests. In order to carry on this work in a thorough manner it is desirable that the Subcommittee on Pharmacognosy be closely allied with the Bureau of Plant Industry and the Botanical Society of America. Again, it is desirable that this committee be in close touch with the large crude drug dealers and importers, for they could undoubtedly supply much information that cannot be gotten in any other way and would be in a position to procure material for the use of the committee. Furthermore, the Subcommittee on Assays should co-operate very closely with the Subcommittee on Pharmacognosy, and the latter should not only furnish the drugs to be assayed but provide, where possible, microscopical or other suitable tests for the identity of the proximate principles obtained in the assays.

But already I hear objections to the development of this work along modern lines. The first is that if there is an increase in the number of vegetable drugs or an extension of the space devoted to their consideration, the Pharmacopœia will be less popular with physicians. To this I merely wish to reply that I have reason to believe that the work will be more popular with physicians in that they will be assured of greater uniformity and efficiency in the official preparations.

The other objection that will be brought forward is that the pharmacist will not be able to apply the information given. While this may be true to a certain extent, it is not an objection which should be allowed to hinder progress, and it is one which is met in

part abroad by the colleges of pharmacy providing special courses of instruction for pharmacists following each revision of the Pharmacopœia. But if the colleges do their part it is only a question of time when this objection can be eliminated entirely.

CONCLUSIONS.

In this paper I have attempted to show that pharmacognosy is a science of fundamental importance to the pharmacist, and that the results of the studies in pharmacognosy are of the greatest value to the physician in assuring him uniform and efficient medicines.

I have called attention to the fact that the foreign pharmacopœias give more uniform consideration to the various subjects and are as strong in their treatment of pharmacognosy as is that of chemistry and pharmacy.

It was pointed out that the pharmacognosy of the U. S. Pharmacopœia has not been thoroughly revised for a decade or more, and that the existing needs demand that it shall be completely modernized. Some of the features that should be considered have been enumerated. The work before the next Subcommittee on Pharmacognosy will be an extensive one, and a wide co-operation is desirable.

Finally, it may be again pointed out that the colleges and schools of pharmacy have a certain share and responsibility in this work. Therefore their courses should in part be based upon the Pharmacopœia and should be such as to forestall the assertion that pharmacists will not be able to use the Pharmacopœia when improved to the extent that existing conditions demand and by virtue of which it should alone exist.

THE BASIC PRINCIPLES OF PHARMACOPŒIA REVISION.

By H. H. Rusby, M.D.

A careful reading of the papers by Messrs. Wilbert and Remington in the December number of the American Journal of Pharmacy prompts a few words of comment concerning the basic principles on which revision should proceed.

Mr. Wilbert's able handling of those principles which he has considered cannot be criticized, though Prof. Remington has

pointed out in good time some serious misstatements of fact. Mr. Wilbert's serious error has been his complete omission of reference to other principles of far more importance than those which he has considered. It is of great importance, as he has pointed out, that physicians' views as to articles which they desire to have recognized in the Pharmacopœia should receive the closest attention, and should be met as far as possible, but it is of equal importance that the pharmacists should have standards of identity and purity for the articles which they are compelled to supply, on demand, without any regard to the views of physicians as to whether that demand is judicious. It is of even greater importance that the administrators of Federal and State laws should have standards for the identity and purity of drugs and medicines commonly imported and used, without any regard whatever to the views of physicians as to the therapeutical merits of those articles. The physicians' duty is to educate the members of their profession as to the proper articles to employ. They have innumerable text-books for this purpose, and they, and not the Pharmacopœia, constitute the medium that should be employed in that educational work. The Pharmacopœia is in no sense a text-book. If physicians have neglected their duty, or failed in its performance, they should correct themselves. Mr. Wilbert calls for a book that will "command the respect and admiration of physicians." They now have more such books than they can use, but the Pharmacopœia was never designed as an object of admiration, however well it might be if it could be admired. It is a working standard, and it should go wherever there is work to do. Moreover, it is a legal instrument and that alone debars it from being made the subject of class legislation. Finally, after all has been said as to what it should be, it may be pointed out that its own fate depends upon its meeting the requirements above referred to. If it should be converted by the committee into a text-book for the sole use of physicians, and only of those of a certain class, it will be at once relegated to that position, will cease to be an official work, and will be superseded by one constructed on the only plan that can fit it for the work for which a national Pharmacopœia is intended, and for the use of other classes who far outnumber the physicians.

THE PURITY RUBRIC AND THE U.S.P. TESTS.*

With Notes on Quantitative Methods for Certain Pharmacopœial Compounds.

By Atherton Seidell and M. I. Wilbert.

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As has been repeatedly pointed out, the Federal and States Pure Food and Drug laws have given to the Pharmacopœia of the United States an entirely different standing from that occupied by it at the time that the present official revision was authorized by the Pharmacopœial Convention, which met in May, 1900, and it is also well known that the Pharmacopœial Convention which is to be held in the City of Washington in May, 1910, will meet, as a legally chartered organization, under entirely different conditions from those prevailing at any one of the previous nine conventions. The responsibilities assumed by the delegates attending this convention are therefore such that they and all others who are in any way interested in the scope and content of the Pharmacopœia of the United States should thoroughly inform themselves beforehand on the general principles that will come up for discussion.

From the point of view of the chemist, no one feature of the prospective revision of the Pharmacopœia is of greater importance than the establishment of reasonable standards of strength and purity, and the co-relating of the several tests and assays with the requirements under what has become known as the purity rubric.

Our Chairman, in his recent circular letter, calls renewed attention to the fact that, "in many cases the Pharmacopœia requires that its products shall be of a definite strength or purity without supplying the method to secure such results."

It is also well known that while many of the chemical tests in the U.S.P. are described in detail, others are but briefly outlined, and in connection with some the language used is ambiguous even to the trained chemist and certainly meaningless or misleading to those of limited experience.

Many, if not all of you, will agree with the dictum that if the Pharmacopœia of the United States is to serve, as it really should,

* Read at the Division of Pharmaceutical Chemistry of the American Chemical Society, December, 1909.

as the standard for purity and strength of the medicines enumerated in its pages, the requirements should be attainable and the tests necessary to establish the identity, strength, and purity of these medicinal substances should be such as can be followed by all of the directly responsible persons engaged in the medicine supply business.

In other words, given a reasonable standard for a substance, the identity, purity, and activity of this compound should be controlled and guaranteed by each person handling it. It follows, therefore, that the passage from the producer to the consumer should be safeguarded from cupidity and ignorance in such a way that at no point will there be opportunity for deterioration or sophistication without at least a fair chance of the shortcomings being detected before the medicine reaches the consumer.

A prescribed purity rubric which is not accompanied by a clearly described analytical method gives an opportunity for differences in the results which may be obtained by even the most careful analysis working with different methods. As a general principle it would, therefore, appear that in so far as it is possible quantitative analytical methods be selected for all substances of the Pharmacopœia for which a purity rubric is given. Furthermore, it is desirable that, other things being equal, the method applicable to the largest number of compounds containing a given constituent should be selected. Such general methods could then be described at some length in the Appendix, and simply referred to under the description of the compound, in much the same way as the now official titrimetric processes are referred to in the U.S.P.

As a practical demonstration of the possibility of elaborating such efficient yet simple quantitative methods, the following laboratory notes on some of the Pharmacopœial compounds examined in the Division of Pharmacology of the Hygienic Laboratory during the past year are herewith presented.

Red Mercuric Iodide.—The Pharmacopœial purity rubric for this salt requires that it contain not less than 98.5 per cent. of pure mercuric iodide. Tests for the identity and for the presence of certain impurities are given by the Pharmacopœia but no quantitative method by which the required purity may be determined. There are a number of processes which probably could be adapted to the present purpose, but the one which has been found most satisfactory is as follows:

A weighed quantity of the sample (about 1.0 Gm.) is mixed

with about 50 c.c. of H_2O, 5 Gms. KOH, and 10 to 20 c.c. of 3 per cent. solution of hydrogen dioxide; the solution warmed gently until the decomposition of the mercuric iodide is complete.[1] The gray mercury residue is filtered on a weighed porcelain Gooch crucible, washed with cold H_2O, dried at about 60° and weighed. $Hg \times 2.2692 = HgI_2$. For the iodide, the filtrate from the mercury is evaporated to about 50 c.c., cooled and filtered into a glass stoppered bottle; about twice its volume of concentrated HCl and 10 c.c. of chloroform are added. The mixture is then titrated to disappearance of the pink color of the chloroform wth 0.1 N KIO_3 solution.[2] The potassium iodate solution may be conveniently standardized against pure potassium iodide. Duplicate determinations upon a sample of red mercuric iodide gave the following results:

	Sample	Wt. of Gooch Crucible 1st.	2nd.	Gm. Hg.	Calc. % HgI_2.	C.c. 0.1 N KIO_3 Sol.	Calc. % HgI_2.
[a]	1.0 Gm.	8.1786	8.6152	0.4366	99.1	43.7	99.2
[b]	1.0 Gm.	7.1758	7.6143	0.4385	99.5	43.7	99.2

The process as here outlined is rapid enough for all ordinary purposes. Only one weighed portion of the sample is required for the determination of both constituents, and the method will no doubt yield concordant results in the hands of different analysts.

Potassium Iodide.—The quantitative method given by the Pharmacopœia for this salt is the usual argentometric titration which, of course, does not differentiate between the several halogens. The titration with standard potassium iodate as outlined above offers certain advantages over the use of silver nitrate, which more detailed experiments will no doubt demonstrate. It is to be noted in connection with the iodate titration that the end point of the reaction is to be taken at the disappearance of the pink color of the chloroform indicator without reference to the pale yellow color of the aqueous layer which persists.

Tincture of Iodine.—The titration of a 5 c.c. portion of tincture of iodine as prescribed by the Pharmacopœia gives rise to somewhat variable results due to inaccuracies in correctly measuring this relatively small volume of the sample. The quantity of iodine calculated from several duplicate titrations may vary by as much as 0.3 Gm. The use of aliquot portions of the sample after dilution

[1] M. Kohn, *Z. anorg. chem.*, **59**, 108–10; *Chem. Abstracts*, **2**, 2911.
[2] L. W. Andrews, *J. Am. Chem. Soc.*, **25**, 756, 1903.

would, of course, obviate this difficulty. Although no determination of the potassium iodide in tincture of iodine is prescribed by the Pharmacopœia, a definite amount of this ingredient is specified by the formula. It therefore appears that a quantitative test for potassium iodide might well be included. A satisfactory method for this determination is as follows: 25 c.c. of the sample are evaporated to dryness in a dish and the free iodine removed by volatilization. The residue after being heated to dull redness is dissolved in water, the solution filtered and diluted to 100 c.c.; 25 c.c. of the latter are then placed in a glass stoppered bottle with 50 c.c. of conc. HCl and 10 c.c. of chloroform and titrated to disappearance of pink color of the chloroform with 0.1 N KIO_3 solution. Several determinations upon two samples of tincture of iodine gave the following results:

Sample No.	C.c. used	Wt. of Platinum Dish		Residue	C.c. 0.1 KIO_3 for ¼ residue	Gm. KI	Gm. KI per 100 c.c. tinctures
		empty	and residue				
234	25	31.8809	33.1160	1.2351	18.6	= 0.3089	4.94
229	25	31.8915	32.9640	1.0725	16.0	= 0.2656	4.25
229	25	31.8855	32.9747	1.0892	16.3	= 0.2706	4.32

The preceding results indicate that this iodate titration method can probably be applied with success to many of the iodine compounds of the Pharmacopœia for which quantitative methods are at present not given. It may also be expected that the determination of mercury in many of its salts can be satisfactorily accomplished by a modification for the method described above for red mercuric iodide.

Lead Acetate.—The purity rubric of the U.S.P. requires that this product should contain not less than 99.5 per cent. of $Pb(CH_3COO)_2 + 3H_2O$, since, however, no quantitative method is prescribed by which this limit of purity may be determined, the following plan was applied to two samples of the salt with satisfactory results: A weighed sample was dissolved in about 50 c.c. of water and a slight excess of dilute H_2SO_4 added. The precipitated lead sulphate was filtered on a weighed Gooch crucible, heated gently over a Bunsen flame, cooled, and weighed. The results were as follows:

Sample No.	Gms. used	Wt. of Gooch crucible		Wt. of $PbSO_4$	Calc. % $Pb(CH_3COO)_2+3H_2O$
		Alone	$+PbSO_4$		
207	0.5	7.1533	7.5706	0.4173	104.3
226	0.5	8.3308	8.7368	0.4060	101.6

Both of the above samples and indeed a number of others failed to give a clear or only slightly opalescent solution when dissolved (1 in 10) in recently boiled water. It is therefore questionable whether this test for limit of carbonate is a satisfactory criterion for judging the quality of lead acetate samples. The gravimetric determination as above outlined shows conclusively that the samples have either lost water of crystallization or, as is more probable, are contaminated with the basic salt.

Acetanilide.—A rapid procedure for the quantitative analysis of this compound is the bromate titration method proposed by one of us in 1907.[3] A standard bromate solution which may be the Koppeschaar's solution of the Pharmacopœia is required. The weighed sample of acetanilide is dissolved in about 50 c.c. of a mixture of one part concentrated HCl and 2–3 parts water, the solution boiled for five minutes and titrated to the appearance of pale-yellow color with standard bromate solution, 1 c.c. 0.2 N bromate solution being equivalent to 0.004504 Gm. acetanilide. The following results were recently obtained upon a sample of acetanilide, m. pt. 112°–113°:

Weighing Bottle and Sample			Am't used for titration	C c. 0.2 N $KBrO_3$ sol. required	Calc. % acetanilide
1st. Wt.	2nd. Wt.	Sample			
14.0581	13.6807	0.3774	all	84.2	100.5
13.6807	13.1282	0.5525	½	61.5	100.2
13.1282	12.5965	0.5317	¼	29.7	100.7

Ammonium Benzoate and other Ammonium Salts.—As has been shown in another paper[4] (Seidell and Menge), a simplified distillation method is well adapted to the analysis of ammonium benzoate samples, and the formaldehyde titration method of Schiff and other investigators is applicable to practically all other ammonium salts for which the Pharmacopœia gives a purity rubric but no quantitative method of analysis.

As an illustration of Pharmacopœial tests that appear to require some additional elaboration it will suffice to call attention to the following:

Sodium Benzoate.—The quantitative test for this salt as prescribed by the Pharmacopœia requires that the sample be ignited at red heat and the aqueous solution of the residue be titrated with

[3] Seidell, *J. Am. Chem. Soc.*, **29**, 1091, 1907.

[4] This JOURNAL, **82**, 12.

0.5 N HCl, using methyl orange as indicator. The experience in this laboratory has shown that even in spite of the greatest care the unburned carbon left after the extraction of the incinerated residue retains an appreciable amount of alkali, and therefore in order to obtain satisfactory results it is necessary to make a second ignition of this unburned and extracted carbon, and add the solution of the second residue to that of the first, before making the titration for the total alkali. The modified procedure may be conveniently carried out as follows:

The weighed sample is ignited thoroughly in a platinum dish, the residue extracted with hot water, and the solution filtered through an ashless filter, the unburned carbon washed several times, and then returned together with the filter paper to the platinum dish and ignited. The second residue is dissolved in water and added to the filtered extract of the first residue and the solution titrated with 0.5 N HCl. The following typical results indicate the necessity of the above modification:

Sample No.	Wt. used Gm.	C.c. 0.5 N HCl required.		Calculated C_6H_5COONa.	
		1st Extract.	2d Extract.	U. S. P.	Modified.
232	1.0	13.15	0.35	94.7	97.4
232	1.0	12.7	0.85	91.5	97.6
232	1.0	12.9	0.5	92.9	96.5
232	1.0	12.6	0.8	90.7	96.5

A number of samples of sodium benzoate from several sources have been examined by the above modified method, but none contained the 99 per cent. pure sodium benzoate required by the purity rubric of the Pharmacopœia. It must be mentioned that the experimental error in the determination could be reduced considerably by either the use of a larger sample or of a more dilute standard acid. With the present quantities, an error of 0.1 c.c. of the standard acid corresponds to about 1.0 per cent. of the salt.

As indicated above, we believe that the foregoing notes serve to illustrate the possibility of adapting more or less well-known quantitative methods of analysis to the examination of Pharmacopœial compounds. Such simple and accurate quantitative methods together with qualitative tests for impurities of a serious character will give a ready means for controlling the purity rubric of the Pharmacopœia, and raise this requirement to the degree of importance that it deserves.

PEROXIDE OF HYDROGEN.

By A. R. L. Dohme, Ph.D., and H. Engelhardt, Ph.D.

Some months ago an article by Dr. Francis appeared dealing with the preserving of solutions of peroxide of hydrogen by the addition of a comparatively small amount of acetanilide. As nearly as the writers remember, it was stated there that the solutions kept well for more than a year, and that a deterioration did not take place after eleven months, as stated by Professor Coblentz. We have had opportunity frequently to examine samples of peroxide of hydrogen preserved with acetanilide from different manufacturers, and in most cases we found that the preparation smelled strongly of nitrobenzene, showing that a decomposition had taken place. Unfortunately we were not able to learn the age of the preparations. If such a decomposition of the preserving agent takes place, the value of the addition of such material should be seriously questioned. A process of W. Heinrici which is covered by the American Patent 825 883 to preserve peroxide of hydrogen solutions depends on the addition of amino derivatives. Acetanilide, which belongs to this class of compounds, is used in this country only, while in Europe the preserving of peroxide of hydrogen is effected by other chemicals.

Among the preservatives used, the following may be named: Renault and Lepinois recommend the addition of boric acid. Allain recommends the addition of about 1 per cent. of sodium chloride, magnesium chloride, or calcium chloride. According to L. Martin, an addition of 0.5 per cent. of borax preserves the peroxide of hydrogen satisfactorily, rendering it at the same time slightly acid without decreasing the titre of the preparation. From many sides, the addition of an excess of acid has been recommended, since this addition both preserves the peroxide of hydrogen solution and neutralizes the alkalinity of the glass. The fact that acid exerts a good preserving power on the peroxide of hydrogen seems to be acknowledged by most of the manufacturers, because we found recently that samples of nearly all the leading makes of peroxide solution prepared in this country (about six in all) of which some had been preserved by the addition of acetanilide, showed on examination an acidity exceeding that allowed by the U.S.P. If in future the use of acetanilide for preserving peroxide solutions should be prohibited, as it should in our opinion, we strongly recommend the use of an

excess of either sulphuric acid or phosphoric acid, inasmuch as these two acids are not liable to be acted upon by the peroxide. The use of hydrochloric acid or chlorides might lead to the formation of decomposition products which might render the peroxide injurious. The amount of the excess of free acid should in our opinion also be increased above what the U.S.P. now allows, say about double the present amount, as the present official amount is soon reduced sufficiently by the alkalinity of glass containers and the shaking experienced in transit to distant sections to bring it below the safety point, resulting in decomposition and blown corks very frequently. No make that we examined only a few weeks ago contained as little acid as the U.S.P. allows; all of them contained more and the most of them considerably more, though of course in no instance enough to interfere with the usefulness of the product or to cause any irritation when used in wounds or any other sensitive surfaces. If free acid in sufficient quantity will fully preserve peroxide of hydrogen and at the same time in no wise interfere with its usefulness as a remedial or prophylactic agent, surely this is the simplest way to preserve it—but this will of course have to be shown and proven by experiments. In our opinion the value and desirability of acetanilide as a preservative for peroxide solutions is open to question.

In No. 45 of the *Schweiz. Wochsch. fuer Chem. und Pharm.*, an article by Fleissig appears, in which it is stated that out of eight samples of peroxide of hydrogen purchased from various German and Swiss manufacturers, only two showed an acidity below that allowed by the Swiss Pharmacopœia, which allows the same acidity as the U.S.P.; the other six having an acidity about three and four times higher than permitted. The author believes that the official amount of acid (0.036 per cent.) is entirely too small, and that an addition of 1 to 3 per cent. of acid should be allowed. This percentage, however, we consider entirely too high, inasmuch as peroxide of hydrogen is frequently used for sterilizing surgical instruments and such a high acidity might corrode these.

Fleissig further gives an interesting account about the stability of the above peroxide of hydrogen solutions. He found that after two months' standing the strength of two was reduced to two-thirds of their original peroxide strength, of four to about one-half, and of two to less than one-quarter when kept in flint glass bottles. When kept in amber bottles, he found that after standing for eight months the strength of three was reduced to two-thirds, of one to about one-third of its original peroxide strength, while four hardly

showed the presence of peroxide of hydrogen. Unfortunately the author only gives a few results about the same preparation when kept in flint glass bottles for a longer period, but from what can be learned from his data the deterioration of the peroxide of hydrogen solution is usually much greater when kept in flint glass bottles than when kept in amber colored containers. It may be stated at the same time that those preparations, in which the percentage of absolute peroxide of hydrogen was reduced to two-thirds of their original peroxide strength only, possessed a rather high acidity. This indicates that higher acidity tends to preserve the peroxide strength of peroxide of hydrogen solutions.

Since writing the above, a paper by Prof. Coblentz on this subject has been presented to the Revision Committee in which he shows that acetanilide is not necessary for preserving peroxide solutions, but also holds out against increasing the acidity because of its interfering with the usefulness of the solution in surgical work, and because manufacturers should use less alkaline glass. We agree with him on the acetanilide proposition, but we think he is wrong on the other two, for even if the amount of acid allowed by the present U.S.P. is doubled as we suggest, it will not affect the most sensitive mucous surface in the human body. And as to glassware, we have seen that both flint and amber glass possess ample alkalinity to soon neutralize the small amount of free acid allowed by the 8th Revision requirements, and when one considers the increased contact with the glass affected by the shaking during transportation, and this must be considered by the Revision Committee, the neutralization of the free acid is greatly augmented as compared with the condition presented by mere standing contact in a laboratory.

PRACTICAL APPLICATION OF THE TWITCHELL PROCESS OF FAT DECOMPOSITION AND RECOVERY OF GLYCERIN.

By W. J. Warner.

The intention of this article is to state the advantages of the process as applied to refining of glycerin and its advantages and applicability to soap making, as well as a description of the process as "worked" on a commercial basis in a plant handling 50,000 lbs. of fat per day.

The Twitchell process has superseded all others in the candle

trade, and is being more extensively used by the soap manufacturers who have recognized the advantages of the process for the recovery of glycerin, in that 95 per cent. of all the glycerin in the fat can be obtained as C.P. This will give yields from: good tallow, 9 to 10 per cent. absolute glycerin; cocoanut oil, 12 to 13 per cent. absolute glycerin; cotton oil, 10 per cent. absolute glycerin approx.; grease and poor tallow, 6 to 8 per cent. absolute glycerin.

The sweet water to be evaporated contains 15 per cent. glycerin instead of from 2 to 4 per cent. as in spent lye, and therefore about 25 per cent. as much water has to be evaporated to make crude glycerin as with soap lye. As an illustration:

The glycerin refiner is supposed to obtain 9 per cent. of absolute glycerin by weight; of the total amount of tallow saponified, actually about 7½ per cent. is obtained; as the tallow contained approximately 10 per cent. of glycerin the loss is considerable. Instead of having to handle 200,000 lbs. of spent lye containing 3.75 to 4.25 per cent. of glycerin, by the Twitchell process of first deglycerizing the fats there would be approximately 60,000 lbs. of sweet water containing 15 per cent. of glycerin. Besides having to handle such a large quantity, the spent lye contains salt, alkali, and fats, which are troublesome to remove; the Twitchell sweet water only has to be neutralized with lime before concentrating, consequently there is a reduction in loss of glycerin to almost nothing and a product of crude glycerin containing 90 per cent. of absolute glycerin against 80 from soap lye, which means a less expense in the refinery. The Twitchell crude is of better quality, containing but a few tenths of one per cent. of ash and C.P. can be made in one distillation, while it often requires three distillations from soap lye crude, so that a still will handle about 30 per cent. more per hour of the Twitchell crude and produce less glycerin foots.

The fatty acid obtained can be saponified with soda ash instead of caustic, which means a net saving of 12 cents per hundred pounds of fat saponified, and finally the fatty acid is of much better odor than the original stock.

In some cases it is of more importance to obtain good color fatty acid than high yield of glycerin, and for working convenience the stock is divided into three classes:

First. No. 1 tallow, mutton tallow, yellow or white cotton oil, cocoanut and palm kernel oil, white grease, olive oil, corn oil, lard, and good stearin. The color and odor are of prime importance.

Second. No. 1 and No. 2 tallow and "off" cotton oil, all the

glycerin possible is obtained consistent with good color. Neither the first nor second class of goods goes to the distillation plant.

Third. Very "off" cotton oil, house grease, olive oil foots, and cotton-seed foots go to the distillation plant and are "robbed" of *all* the glycerin, as color, in the Twitchell plant, is of no importance —the distilled product will be white any way.

Outside of the distillation plant the work is carried on exclusively in wooden vats or tanks, each tank numbered for convenience and record, and are designated as decomposing, acid boil, Twitchell, and storage. The decomposing and acid boil tanks are preferably lead lined. The Twitchell tanks are closely covered with snug fitting lids with an "up take" for steam. Experience has taught that certain precautions must be taken to carry out the process successfully and economically and these will be referred to at the proper time.

Assuming that a plant has just been installed, it is of prime importance to understand that in a glycerin refinery and a Twitchell distillation plant twenty-four hours make one day and seven days make a week and there are fifty-two weeks in one year, and there are no Sundays, holidays, or even lunch hours, one shift of employees relieving the other without any interruption of work. The plant is ready, a tank car of cotton-seed foots has been set about 5.30 P.M., each tank car is fitted with a closed steam coil with outside connections, the coil is connected with a steam supply in the "pump house" before which the tank has been placed, and steam turned on to heat and soften the "foots" for pumping in the morning. One of the precautions for successfully working the process is that the fat must be freed from all dirt, lime, bone, tissue, and other impurities, which sounds complicated but is very simply done. The dirt settles and is run off to the sewer. The contents of the car being softened the pump is started. A "pet cock" on the pressure side of the cylinder enables the operator to obtain a "running sample" of the contents of the car. This amounts to about three gallons. This sample is taken to the laboratory, thoroughly mixed and divided into four parts, three parts sealed in pint jars until the car of stock is run through and the fourth part for "immediate analysis" of total fatty acid. Five to 10 grammes are weighed into a 500 c.c. Erlenmeyer and 50 c.c. of a 5 per cent. alcoholic soda solution added. Boil to dryness. Add an excess of dilute sulphuric acid and boil until all soap is decomposed. Transfer to a separatory funnel using some petroleum ether to rinse Erlenmeyer. Draw water and acid off the Erlenmeyer. Pour the solution

of fatty acids in petroleum ether onto a filter and filter into a tared dish, add more ether to the water, thoroughly washing Erlenmeyer and separatory funnel, each time pouring the ethereal washings onto filter. Finally wash filter and funnel stem. You now have the total fatty acids in a petroleum ether solution in a tared dish. Dry until the loss is not more than 0.02 grammes in 20 min. at 100° C. Before the pump was started six to nine inches of water was turned into the decomposing tank and the steam turned on, an open coil being fitted in the tank. (The water is only used in starting a new plant, thereafter the decomposing tank will contain an indefinite amount of waste acid from the rest of the plant.)

Cotton-seed foots are 50 per cent. saponified when received and are "decomposed" into "black oil" by boiling with sulphuric acid. When there is waste acid in the decomposing tanks it is started boiling the same time the car is being emptied so that the saponification is broken up almost as fast as it can be pumped. After boiling an hour it is tested by allowing same to run off a paddle and should show no trace of soap. It is allowed to settle, the water and dirt going to the sewer. (If the first boil has been on waste acid the acid is exhausted when it tastes salty.) After running the settlings into the sewer add about three inches of water and 1 per cent. of sulphuric acid and boil until fat is brilliant and clear. Allow to settle. This is waste acid, tastes sour, and does for the first boil on the next car. After settling "skim" the oil from the top with a gravity suction pipe into "black oil storage tank." From storage the clear black oil is run into "acid boil tank" and shows a varying analysis: dry black oil; 50 to 75 per cent. fatty acid; 2 to 4 per cent. unsaponified; 4 to 2 per cent. glycerin; 1 to 2 per cent. moisture; ½ to 1½ per cent. dirt.

In the acid boil tank 1 per cent. of sulphuric acid and just enough water to cover the coil are added. The precaution here is that the waste acid should be 18° B, for cotton-seed foots, to obtain a good product; this waste acid goes to the decomposing tanks. The fat is boiled in the acid boil tank for about two hours, a sample taken for analysis and the stock is ready for the Twitchell tank.

It requires a man of intelligence somewhat above the average unskilled employee to be "Twitchellman." He does the "rough analysis" of the tanks during operation and keeps the records of each tank. Where there are so many tanks it is practically impossible to weigh each charge, so that the tanks are measured and weight of contents per inch calculated. Six inches of water are

run in the Twitchell tank and thirty-two inch (30,000 lbs.) black oil, cotton-seed foots being handled, 3 per cent. of the weight of the charge of black oil of Twitchell reagent is added, steam turned into the perforated coil, the trap door closed, and the Twitchellman starts his record of that particular tank. First he would ascertain the per cent. of fatty acid in the black oil as follows:

The oil would be put in an Erlenmeyer and heated until absolutely dry. Bluish vapors on the surface of the oil indicate a dry condition. Fifty c.c. alcohol are put into another Erlenmeyer and warmed, 4.1 c.c. of the dry oil are run into the 50 c.c. alcohol, alkaline blue used as an indicator, and half normal NaOH run in until neutralized. The number of c.c. of NaOH multiplied by 4 gives the per cent. of fatty acid. The result is noted in the record. This record must show the number of the tank, amount of charge and class of goods, the per cent. of fatty acid the goods contained, amount of Twitchell reagent added, the hour it started boiling, the hour it stopped boiling, the number of hours of the first boil, amount of sweet water run off, and the B° strength and per cent. of fatty acid at end of first boil, the hour of starting and ending second boil, number of hours boiling, amount of Twitchell fat run off, and per cent. of fatty acid at the finish. The length of time for the first boil is about thirty hours and should show from 87 to 90 per cent. fatty acid. After settling the glycerin water is run off into a storage tank, the number of inches and B° taken. The second boil lasts about twenty-four hours; no reagent is added to the second boil. A sample is taken and should show 93 to 95 per cent. of fatty acid, it is allowed to settle and is ready for the distillation plant. The Twitchell fatty acid, as the product is now known, shows on analysis: 92 to 95 per cent. free fatty acid; 4 to 1 per cent. unsaponifiable; 2 to 3 neutral fat; 1 to ½ per cent. dirt.

When the fat has thoroughly settled it is run into an intermediate storage stand and then into the "dry boxes." These dry boxes are of cast iron, built up of sections 2 ft. 6 in. square with machined edges to make a tight joint, the boxes are 5 ft. wide, 5 ft. deep, and 10 ft. long, and when the fat is dry and at about 275° F. measure 285 lbs. per inch. Each box is fitted with a closed brass coil and connections to the still. It is essential that the fat be absolutely dry when fed into the still. The distillation is carried on by live fire, each still being fitted with a perforated cross on the bottom of the inside of the still through which superheated steam is injected. A slow fire is started under the still and the vacuum pump started.

When a vacuum of 28 in. is obtained, 32 in. of fat, about 9100 lbs. are drawn into the still and the temperature gradually raised to 475° F. on the still and 575° F. on the superheater. The superheated steam is then turned into the still through the perforated cross and collection of distilled fatty acid begins. This is continued, slowly feeding fat into the still until 155 in. has been fed out of the dry boxes, approximately 34,000 lbs. The stillman keeps close watch of measurement of the distilled product because he only obtains 82 per cent. of what he feeds in, the residue gradually becoming bulky. When the "charge" has been fed in, the temperature has been raised gradually to 525° F. on the still and 650° F. on the superheater and the time has been about three days of twenty-four hours. The distillation is continued until fat begins to color, when the fires are drawn, superheater shut off, and temperature on the still allowed to drop below 500° F. Then the tar is pumped into a tar still. This tar seems to have a "flashing point" of 500° F. in contact with cold air. The safe point to pump is 475° F.; it has been pumped at 495° F. but *only* once, and when the wreck was cleaned up the yield of tar was not quite as large as it should have been. The tar still is the same as the fat still, except it is not operated under a vacuum. The remaining grease is blown out of the tar with superheated steam, the tar allowed to cool, run off and barrelled. In the meantime, the fatty acid still is again started. The process described applies only to the lower grade of fat or Class No. 3. Classes No. 1 and No. 2 do not go to the distillation plant. The Twitchell tank for handling these goods is the same as for Class No. 3 with the addition of being fitted with a steam jet immediately under the cover and above the surface of the fat. The method followed for, say, prime tallow applies to all other fats in Classes No. 1 and No. 2.

The tallow is "steamed out" of barrels into the acid boil tank and 5 lbs. of sulphuric acid to each barrel of tallow added and boiled for two hours, then allowed to settle overnight. Run water off and drop to Twitchell tank. Assuming the Twitchell tank is clean, add about ⅓ as much water as there is tallow and ¼ of 1 per cent. of the weight of tallow of reagent and boil with open coil until test shows 90 per cent. free fatty acid, shut off open coil and turn steam through jet and keep it going all during the settling process. Air coming in contact with the fat at this stage would discolor it. When the sweet water has settled, run off, put in more fresh water and give second boil until test shows 96 per cent. free

fatty acid, shut off steam, turn on jet, and add barium carbonate mixed with a little water in proportion of ¼ lb. barium to every 500 lbs. stock. In a few moments take a sample from cock in side of tank and test if water is neutral to methyl orange. If it is, steam may be turned off jet and water allowed to settle. The fatty acids are now perfectly stable and may be stored in wood until wanted.

The glycerin waters are treated with milk of lime until distinctly alkaline, the liquor being kept agitated to prevent settling of the calcium sulphate. The treated glycerin water, or sweet water as it is designated, is pumped through a filter press into a storage tank from which it is drawn for evaporating into crude. This can be done in an open tank with closed steam coil or in a vacuum apparatus either single, double or triple effect, to 34° B, which for Twitchell crude is 90 per cent. absolute glycerin and 80 per cent. absolute glycerin for soap lye crude. All crudes are analyzed before refining, the acetin method being generally used by the large refiners, experience showing the results obtained are more nearly accurate than by the bichromate method.

To conduct this test take: 1½ Gm. crude glycerin; 10 Gm. anhydrous soda acetate; 8 c.c. acetic anhydride. Boil under reflex condenser for 1½ hours, cool a little and dissolve tri-acetin formed in 50 c.c. warm water. Do this while still under reflex, cool and filter, washing filter well, add phenolphthalein to filtrate and neutralize excess of acetic acid with 2 per cent. solution NaOH, taking *great care* not to run over end point or let solution become alkaline locally while adding the NaOH. Then add an excess of 10 per cent. solution NaOH and boil 20 minutes. Titrate excess, also run blank on the 10 per cent. NaOH. Titration of blank minus titration of excess divided by weight of sample, multiplied by 1.533, equals per cent of glycerin.

The following yield and capacity tests (the cost test for obvious reasons being omitted) will indicate how thoroughly a plant and laboratory can check results.

Cotton foots..703,580 lbs. Laboratory test, 58.32 per cent. fatty acid
Reagent ..... 17,812 lbs. Laboratory test, 75 per cent. fatty acid

This shows for the foots....410,333 lbs. fatty acid
and for the reagent.... 13,359 lbs. fatty acid

A total of.....423,692 lbs. fatty acid to be accounted for.

The product, based on a total distillation:

Distilled fatty acid	355,725 lbs.	83.97 per cent.
Tar residue	65,419 lbs.	15.44 per cent.
Total recovered product	421,144 lbs.	
Showing a loss of	2,548 lbs.	.59 per cent.
	423,692 lbs.	100.00 per cent.

The yield based on analysis of black oil:

Distilled fatty acid	342,505 lbs.	82.31 per cent.
Glycerin	5,775 lbs.	1.40 per cent.
Tar	65,419 lbs.	15.72 per cent.
	413,699 lbs.	
Laboratory test	58.32 per cent.	410,333 lbs.
Glycerin	.82 per cent.	5,775 lbs.
		416,108 lbs.

Equals a loss of 2409 lbs., or .60 per cent.

The yield based on total product handled:

Distilled fatty acid	355,725 lbs.	49.31 per cent.
Glycerin	5,775 lbs.	.82 per cent.
Tar	65,419 lbs.	9.70 per cent.
Total recovered	59.20 per cent. of foots	
Laboratory test	59.55 per cent.	
Loss	.35 per cent.	

The manufacturers of lard compounds refine their own cotton oil and sometimes decompose the resulting foots into black oil for economy in storage. This black oil is marketed for Twitchell, a test of a car showed: black oil, 45,460 lbs.; reagent, 2025 lbs.

Product:

Distilled fatty acid	30,618 lbs.	67.35 per cent.
Glycerin	3,173 lbs.	6.98 per cent.
Tar	11,028 lbs.	24.25 per cent.
Loss	641 lbs.	1.42 per cent.
	45,460 lbs.	100.00 per cent.

The yield of tar on this test was excessive and indicated that some one was not familiar with the process of decomposing foots to the advantage of the distillation plant. If the process is properly handled, the quality of the stock considered, the yield of tar rarely exceeds 12 per cent. of the amount of Twitchell grease handled.

Test on house grease:

Amount of grease 30,750 lbs., less moisture 6 per cent.	30,566 lbs.
Reagent	675 lbs.

ANALYSIS OF GREASE.

Titre	39.8 per cent.
Saponified value	O.K.
Fatty acid	26.8 per cent.
Moisture	.6 per cent.
Unsaponifiable	.96 per cent.

ANALYSIS TWITCHELL FAT

Fatty acid	92.39 per cent.
Unsaponifiable	1.96 per cent.
Moisture	Trace

ANALYSIS OIL BLOWN OUT OF TAR.

Fatty acid	3.86 per cent.
Unsaponifiable	96.14 per cent.

ANALYSIS DISTILLED FAT.

Titre	40.5 per cent.
Moisture	.8 per cent.
Unsaponifiable	.65 per cent.
Saponifiable	98.55 per cent.

Yield:

Distilled fat	24,182 lbs.	77.40 per cent.
Glycerin	1,360 lbs.	4.40 per cent.
Tar	2,200 lbs.	7 per cent.
Unsaponifiable	1,172 lbs.	3.80 per cent.
Loss	2,327 lbs.	7.40 per cent.
		100.00 per cent.

The loss on handling house grease was excessively high and was due to the large percentage of volatile or higher fatty acids

in the grease, which passed through the entire system of condensors, even through the duplex wet vacuum pump, appearing in billows of grease, perfectly white on the surface of the hot well. They clogged the valve chambers of the pump so that the plant had to shut down, the grease be cleaned out and new valves put in. To have collected and identified those fatty acids would have been an interesting experience, but being a commercial plant one car of such stock gave all the experience cared for.

SAMPLING OF GROUND SPICES.*

By Harry E. Sindall.

This subject is of considerable interest to the food chemist. It is a well-known fact that the spices as imported contain considerable foreign matter, mostly small pebbles and sand, to remove which is a difficult task for the miller, especially the pebbles. Another point to bear in mind is that some spices after being ground have a tendency to separate into layers, depending upon the difference in specific gravity of the particles. This tendency is most noticeable in black pepper.

The most satisfactory method found by the writer for the sampling of black pepper is, first, to catch about 8 to 10 oz. of the pepper as it leaves the mill at different intervals during the process of grinding. Then these several samples are thoroughly mixed together, the mixture separated into four parts by means of a spatula, one of these quarters divided into four parts in the same manner, and the division continued until a uniform sample of about 4 oz. is obtained. In proceeding with the analysis, care should be taken to mix the contents in the sample bottle before each weighing.

If ground black pepper, the hulls of which are lighter in weight than the other constituents, be allowed to remain in a pile for a few days, a sample taken from the surface would far exceed the standard allowance for crude fibre, and would run low in acid insoluble ash, while a sample taken after throwing off the top layers would run

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* Read at the Boston meeting of the American Chemical Society, December, 1909.

just the reverse, that is, low in crude fibre and high in acid insoluble ash, due to the sand working through the product.

From experience, I have found that to get satisfactory results from ground spices packed in cartons or cans, it is necessary to procure at least four cartons or cans of the same kind, to empty the contents and to mix them thoroughly together, after which the samples are obtained by the method described above; as it is generally unfair to pass an opinion on a smaller sample, unless, of course, the product is highly adulterated, in which case the adulterant could readily be detected by aid of the microscope in any one package.

The same method of sampling gives very good results in the cases of cinnamon and ginger, although aside from the sand's working to the bottom the separation here is hardly noticeable.

With spices like mace, cloves and nutmegs, which contain considerable oil, the sampling is much easier. I have found by going over a pile of the finished products with a spatula, taking about 2 mgs. here and there, shaking up a little with a scoop, and repeating the sampling and mixing with the samples thus taken, the results obtained are good duplicates of the results obtained with samples taken by the first method, *i.e.*, when both samples have been taken from the same material.

The samples of whole spices obtained from brokers are often very misleading. They are, as a rule, very clean. On one occasion, the broker's sample ran something like 1.75 per cent. acid insoluble ash, but one bale of the material after grinding and being sampled by the first method mentioned ran between 7 and 8 per cent. acid insoluble ash. On sending my report to the broker he declared that there was some mistake and desired a sample. I sent him about fifteen pounds of the whole material out of another bale, and in due time he offered to take back the goods, which offer was immediately accepted. I should say that these bales weighed about 300 lbs. each. I merely mention this to show the necessity of taking a large sample and subdividing it.

In mustard, the best results are obtained by sampling the whole seed, for this is where the adulterant is found; especially is this the case with the brown seed. The sampling is done with an ordinary coffee sampler. About a handful of the seed is taken from each bag and examined separately under a strong magnifying glass. The adulterants here, which are readily detected, are chiefly rape, turnip,

or charlock seeds. A sample taken from any part of the dry mustard flour may be taken to test for artificial color or added starch, as these adulterants are generally worked up pretty well in the material.

Red pepper seems to be the most difficult spice to obtain a uniform sample, owing to the manner in which the pods are ground. The first method is impracticable with this spice, while the results obtained by sampling, using the second method, are about fair. The most satisfactory method to employ is the following:

A metal tube about one inch in diameter and about three feet long, with a sharp end, and so constructed that it can be forced from the top of the barrel containing the red pepper through to the bottom of the barrel, is used. The tube is emptied, inserted several times through the pepper in the barrel, the samples are mixed and subdivided until a sufficient sample is obtained for the analysis. I may say that this method of sampling gives good results with the majority of the spices where samples have to be taken from barrels.

CONCERNING THE AMERICAN MATERIA MEDICA.*

By John Uri Lloyd, Cincinnati, Ohio.

(Concluded from page 11.)

The Lobelia Epoch.—One of the main tenets of the Thomsonians was the employment of no poisonous remedies. They aimed to exclude all mineral substances, as well as every vegetable substance that could produce death or that could be reckoned among those antagonistic to life processes. Thus the list of remedies used by Thomson omitted even such drugs as sanguinaria, or veratrum, or gelsemium.

Comes now the irony of fate! The sheet anchor of the Thomsonians was lobelia. A *lobelia course* was preliminary, in most instances, to any other form of treatment whatsoever. A vital blow was now struck by the antagonists of Thomson. *Lobelia was by them thrown into the list of poisons!* Many were the deaths reported as resulting from the heroic medication of the Thomsonians in which lobelia was shown (or asserted) to have been the chief offender. Came at last the arrest, prosecution (or as some prefer

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*Address delivered before the Philadelphia College of Pharmacy, November 4, 1909, being the third of a series of special lectures for 1909–10.

persecution), and trial of Thomson, and next the famous trial of Dr. Frost. This persecution, as the Thomsonians accepted it to be, did not dismay Thomson's votaries or discourage their leader. On the contrary, it led to the more pronounced arraying of the forces of Thomson against the legalized medical profession. Thomson became a martyr in the eyes of thousands of adherents from Massachusetts to the Carolinas. A mighty rebellion had been bred among the people, having as its centre Thomson and his system of medication, its object being the extermination of the "fashionable methods" of treating disease by what was accepted as death-dealing processes imported from Europe. It was a second American Revolution, that marshalled in its ranks, as insurgents, a far greater army than had marched under the flag of Washington, an army made up of those who fought in the other Revolution as well as their descendants. The prison cell of Thomson and the prosecution of Dr. Frost became living watchwords and mighty battle cries. Forgotten was the good of established therapy. Overlooked were the sacrifices as well as the kindnesses of physicians engaged in orthodox medication. All who practised by authority were thrown into one group, and that group received the titles already mentioned, "bleeders," "blisterers," "salivaters," and even "murderers!" Most excruciatingly did they picture the process of salivation by the mercurials, the depleting effect of cantharides blister, the exhaustion of those bled of their life blood, the terrible suffering of those to whom were applied the horrible tartar emetic plaster. In every family was an object lesson.

Through it all, such men as Barton, Dunglison, Zollickoffer, Tully, and others pursued the even tenor of their way, seemingly unaffected. But yet the influence of Thomsonianism was fast undermining orthodox heroic medication. It is questionable, as this speaker looks back at those days and events, whether any other process or mode of action could have accomplished that which followed the methods of the revolutionists, although many believe that, had plain discussions in a balanced way been employed by the members of the schools of medicine, the cruel features of such medication as then prevailed would sooner have disappeared. Be this as it may, the regular medical profession generally, conceding nothing, arrayed itself against the outsiders. It protected the theory and maintained the practice based on the application of the heroic in medication.

THE CRUELTIES OF THOMSONIANISM.—But the Thomsonian

revolutionists were at a disadvantage not alone in the direction of the unquestioned energy of lobelia. Accompanying methods that they advocated partook of much that would, to-day, be called barbarism. Their large doses of compounds containing capsicum and myrrh were excruciatingly severe. Their sweating process, repeatedly applied to the same patient, was debilitating. Their "composition draughts" were almost unbearable, as this writer knows from experience. These, combined with other features of a course of Thomsonian medication, seem to have been dreaded by many of the afflicted almost as much as were the blistering, bleeding, and salivating processes of Thomson's antagonists, although the after-consequences were surely not as necessarily lasting or as fatal. Thomson had unquestionably combined the sweating methods of the aborigines of America with the emetic processes prevalent in "fashionable" medication, complicated with which was the burning as by fire of irritating materials like capsicum and bayberry. Taken altogether, the people, in escaping from one form of torture, had become involved, although to a lesser degree, in another. A *little* devil had replaced a bigger one. Then, too, it must be remembered that in the regular profession an educated man possessed of more or less misapplied learning usually conducted the ordeal test, while in the other case whoever could read or could comprehend the processes promulgated in Thomson's patent was considered fully qualified to treat disease. The one was scientifically or professionally cruel, the other cruelly unscientific and unprofessional. Helpless were the sick in the hands of either or both.

Again a spirit of unrest came upon the people. Was it necessary that the step of the man of medicine should make the afflicted shudder? From him children ran in affright. Did the treatment of disease demand this?

Wooster Beach, the "Father of Eclecticism."—Just at this point came Wooster Beach (1833). Unlike Thomson he was an educated man. Like Thomson he was a revolutionist. Unlike Thomson he was a believer in colleges and in education. Like Thomson he had great faith in America's materia medica. A graduate of the medical department of the University of New York, his first publication, "The American Practice of Medicine," published in three volumes in New York in 1833, was rebelliously addressed to the people and not limited to the profession of medicine. Thus, although believing in college education, he defied the legalized

practitioners, in that his publication, concerning medicine, was presented to a non-professional audience. Thus, Wooster Beach antagonized both sections we have been considering. It was at once seen that he had invaded the field of Thomson, but not in any wise as his disciple, and that he had also irrevocably violated the ethics as well as the dogmas of the dominant school. The Thomsonians turned upon Beach and his followers, abusing them even more viciously than they did their old enemies, the "bleeders." The regulars raised their battle-axes. Between the two stood Dr. Wooster Beach, the prey of both. We have seen Thomson to be a man of indomitable will, determined and fearless and most fertile in resources, though illiterate. Let us now consider his rival.

Dr. Wooster Beach was conversant with the literature of the past. Barton's "Collections," Rafinesque's "Materia Medica Americana," Schoepf's "Materia Medica," the writings of Dunglison, Tully, and Zollickoffer, the Pharmacopœias of the United States of 1820 and 1830, the Proceedings of the different medical societies, these and such as these were to him familiar. With the ideal of reform but with high regard for others' efforts, he unhesitatingly selected from all these sources that which he considered best, his object being the kindly treatment of disease and a replacing of powerful remedies by those less energetic, whenever such were capable of serving equally as well. He believed in a reduction of energetic doses to such an extent that poisonous drugs, if used, should produce no toxic or harmful effect, and in the modifying of compounds in which poisons took a part, so that if the disease was not cured no dominating constituents should thereby cause fatal results.

The motto adopted by Beach and his followers, "*Vires Vitales Sustinete*" (Sustain the Vital Forces), made it necessary that these objects should be accomplished. It was the opposite of that of both his antagonists, for both depleted. Thus Beach, the antithesis of Thomson, and yet his colaborer, became the founder of an American system in medicine, antagonistic to that of Thomson. His followers believed in education, they believed in colleges, they believed in surgery and the sciences, and in rationally employing whatever could be properly utilized, from whatever source it came, whilst the methods of Thomson were those of teaching the people *directly*, through travelling agents and by person. Antagonistic were these two, in all points touching systematic medical education. The name "*eclectic*" was applied to the followers of Beach, who

claimed the privilege of selecting from any source whatever, as they saw proper, whatever could be properly utilized. They made their code of ethics the "Golden Rule" only. They did not recognize the authority of the regular profession as concerns doses or medicines. Thus, they too were "irregulars" in the eyes of the legalized part of the medical profession and needs be suppressed.

But yet the widely divergent Thomsonians or botanics (for Thomson eschewed minerals altogether) were, strangely enough, confounded by most legalized practitioners with the eclectics, whose precepts were merely those of greater kindness to the sick and a closer study of the American materia medica than was practised by either the Thomsonians or the regulars. The eclectics, as was their duty, even more forcibly and systematically than did the Thomsonians, fought bitterly the bleeding, blistering, mercurial purging and salivating methods still prevalent in the mother school, but not less earnestly did they oppose the sweating, the vomiting, and the heroic, enervating "courses" of the Thomsonians. But not even the eclectics of that early day could altogether escape the prevalent theories concerning disease and disease names, as well as many questionable methods, inculcated from abroad. Slow, indeed, is the process mankind travels from established error to intellectual freedom! Aiming to parallel, in a more kindly way, the processes of both the regular school and the Thomsonians, the eclectics yet believed in treating diseases by name, in the use of violent cathartics, and, as is known, in this direction they (King) introduced the "resin of podophyllum" (1835), subsequently known as the "eclectic calomel." They also believed in counter-irritants, producing thus running sores, for the purpose of relieving underlying affections, and in this direction devised their "compound tar plaster," to be used instead of old school applications of croton oil, cantharides, and tartar emetic. Whoever has seen its effect will not question its severity. They believed somewhat in emesis, and for this purpose devised "compound tincture of sanguinaria," and "compound lobelia powder," utilizing in the first a drug introduced by Barton, and in the other the banner drug of Thomsonianism. In view of such facts as these, as perhaps seems reasonable, the adherents of the eclectic school, coming in the height of the warfare between Thomson and his antagonists and at the most vicious period of that conflict, were viewed as *renegades* by the old-school physicians, and by the Thomsonians as *pirates*. Between 1840 and 1860 this trian-

gular war waxed hotter and hotter, each faction fighting bitterly the others, but each engaged earnestly, as they saw life's duties in their task of relieving mankind of ills, even though the attainment of the object necessitated, where heroic medication was involved, the death of the individual.

Warring of the Heroics.—But in all this, let us not forget the people who were so vitally concerned in this war of the professions. The good in each benefited the people, the wrong of one or of all injured them. Each home in America became involved, one way or the other. Under the influence of Thomson and of Beach home-made remedies increased, whilst under their combined but yet disconnected attacks criticisms of the profession became more pronounced. The cruelties of the transplanted mediæval ages, as exemplified for centuries in bleeding, blistering, and salivating, were illustrated in print and depicted in lecture, in the home, the school house, the church. The dominant school as well as the Thomsonians felt the touch. They indignantly resisted, but yet under the influence of transpiring events they lessened their doses and gradually abandoned their depleting processes. Then, at last, it was discovered that barbarism, in these lines at least, was unnecessary. But yet, all seemed to believe in fighting disease, not in preventing its occurrence.

Came, now, in the seeming day of victory, tribulation to the Thomsonians. The people had become better educated, better fed, and better clothed. The methods of times gone by would no longer be tolerated. The eclectics, too, felt the influence of the times, and discovered that their enormous and too often nauseating doses of syrups, of vinegars, and of compound tinctures were neither desirable nor necessary. They, too, began to look upon what had previously been their ideal of greater *kindness* as a process of less *cruelty*. About 1860, came the ending of the more heroic phases and processes of eclectic medication. The old school, as shown by the records, had during this period assimilated many remedies native to America, the Thomsonians had about abandoned their lobelia courses and had lessened the enormous doses hitherto employed, whilst the eclectics had discovered that disease expressions could be controlled by more kindly methods and by smaller doses than had been advocated by Beach. A great number of the remedial agents suggested by Barton, but neglected during this period by his old-school disciples, had in small doses become favorites in the eclectic school, some of them being reintroduced from

eclecticism to the school of Barton. Some remedies developed by the rivals of the school with which Barton affiliated had also become established, in many cases, the world over. To such an extent was this true as to have given (about 1860) to the major number of American remedies of the eclectics the name, "eclectic medicines."

ADVENT OF HOMŒOPATHY.—Let us now consider a phase of the American materia medica as yet neglected but of more than a little consequence. This was the advent of homœopathy about the beginning of the last century. The homœopathists believed in kindness to the sick and practised it. They believed in sanitary methods and in good nursing, and, as far as possible, these precepts were enforced. They believed in cleanliness and made this one of the tenets of their practice. They believed in small doses, even unto what, in the opinion of the other schools, was mathematical extermination of a remedy. These together constitute some phases of preventive medication. Such as this appealed to many of the more cultured portions of the people, who, in the face of ridicule, gave the homœopathic physician a hearing. About the middle of the last century the influence exerted by the homœopathist was certainly greater than was appreciated by those involved in other directions in medicine. Indeed, it is questionable whether homœopathy has been, even to the present day, credited with its due part as concerns the extermination of the conspicuous barbarisms connected with the overdosing and underfeeding of those days, and its attendant evils. Be this as it may, the advent of homœopathy at the beginning of the last century was considered so unimportant and their beliefs so chimerical as to have attracted little attention other than passing ridicule from any of the active forces we have mentioned. The chief antagonism against homœopathy came from those who had no conceptions of preventive processes but who believed that the value of medication consisted in heavy, materialistic sledge-hammer doses. By such, it was felt that homœopathy meant an abandonment of the afflicted to the enemy, disease. Those who advocated homœopathy were naturally thrown into the class of charlatans and quacks. Their opposition to heroic measures was considered as a neglect of the patient, while the theory of attenuations was incomprehensible. Nor was this view of the methods of the homœopathists restricted altogether to the dominant school, for the eclectics and the Thomsonians differed from the homœopathists as concerns dosage about as much as did the regulars. A common cause, how-

ever, threw the minority (irregular) sections together, in the face of a general enemy bound on their subjugation. Their efforts, regardless of the theories that each maintained, were, when necessary, united against professional extinction of the "irregulars." Thus the crusades went on, until about 1860 it became apparent to a few leaders in the eclectic section in medicine that not only was there no necessity for excessive doses of even innocuous drugs, but that the action of drugs, in a therapeutic sense, was far separated from active physiological shock. It became apparent, indeed, that shock to the patient, even that of post-eclectic methods, often retarded or even *prevented* a return to the normal. Thus was introduced a new epoch in the direction of American medicine as concerns the men now chiefly concerned in the evolution of the American materia medica.

PART III.

CONDITIONS IN 1860.—Let us remember that under the aforenamed influences and the age of reason, in 1860, the physician of the allopathic or old school, who bled, blistered, and salivated, had become the exception. Indeed, the cantharides plaster and the croton-oil vesicant were at that date about all that lingeringly maintained a place in the practice of the followers of old-time heroics. Let it be remembered that the followers of Thomson had changed their name to *physiomedical,* and that they had practically abandoned the sweating and the *lobelia courses* of their founder. The eclectics, also, as the result of reflective opportunities and experimental experiences, as well as from their pharmacy studies of plant products, had abandoned many of their cruder compounds of the early days of Beach, and had become discouraged as concerns a system of therapy dependent upon the physiological action of such remedies as they had themselves introduced and developed. Even cathartics were no longer viewed with favor.

JOHN MILTON SCUDDER (ECLECTIC REVOLUTIONIST).—Came, then, John M. Scudder, a man of resources, an observer, independent, hopeful. If he did not originate the theory so actively promulgated by him, he grasped the situation, and, being at the head of the eclectic school, commanded their forces. With a courage that even his antagonists (for necessarily he had many) admired, Scudder berated the weaknesses in the eclectic school. Although he never lost an opportunity to attack wrong of outsiders as he saw the wrong, his crusade was directed more in the direction of over-

coming evils from within and correcting home faults. The "eclectic compounds" of old were within a reasonable period practically exterminated by him and his adherents. Conglomerations (syrups, compound tinctures, powders, "shotgun mixtures," etc.), with a few exceptions, were irresistibly decried. The theory of diseases being treated *by names* was combatted, both with ridicule and with argument. The *specific action* of a drug, not the guessing of the effect of a mixture, became his slogan. The individuality of a *single* remedy was studied in connection with its action in varying phases of disease expression. No longer was a disease viewed as an invading enemy known by a name, but as a rational departure from the normal, in which a systematic wrong might, under many disease names, cry for the same remedy. The doses advocated were very small, and for the therapeutic action only, never the physiological shock. Such views were, in the very nature of things, revolutionary. Antagonists from within the eclectic school called Scudder a pseudo-homœopath. They resisted and combatted him, separately and collectively. Serenely, however, Scudder, unruffled, pursued his carefully devised course. Neither vindictive nor personal was he, his object being the eradication of the questionable materia medica part of eclectic medication, and the rational application of drug remedies where it could be proven that they exerted a direct, kindly influence. Never torture a helpless man. Why should the sick be fed drugs and doses that the well cannot eat? That was his argument. He sought in homœopathic literature that which the homœopathists had in his opinion established, and he credited them therefor. He likewise sought the good that he felt had been established in Thomsonian directions, and to the followers of Thomson he gave a kind word. With no less care he searched the materia medica of the regular school, culling freely therefrom and giving credit therefor. But in it all, his doses were attenuations, as contrasted with anything preceding him in eclecticism, and many were the kindly remedies, before untouched, that he introduced to replace those more severe. He claimed that the simplest form of the remedy was the one that the physician could best comprehend, either in action or dosage, and rejected polypharmacy and its conglomerates as neither scientific nor rational. He demanded in eclecticism that the remedies employed should be simple pharmaceutical preparations, of established drugs, under their true scientific names. "Let the doctor do the prescribing and know what he prescribes," threaded his argu-

ments. In it all, however, he appealed more directly than any before him had done to the American materia medica, inaugurating a process of clinical therapeutic investigations more systematic, perhaps, than had previously been comprehended. His antagonists within the school were many, because the ideals of the past were being shattered by the man who so well appreciated both the opportunity and necessities of the present. But of this in its detail we need not speak, our object being to introduce the materia medica problem of the epoch of 1860. Through the heirlooms of the past and the processes of the then present, the eclectics had come to be the principal and the recognized developers of the American materia medica, which had once been the hope of such as Schoepf, Barton, Thacher, Thomson, and of Beach. To the plant remedies used by these men, Scudder and his adherents now added, one by one, as necessity and opportunity for investigation presented, this or that remedial agent before unknown, abandoning many in turn as being less valuable than others thus introduced. Each drug was studied after the new method, which was not that of the destruction of the drug's individuality, not that of compounding it with a number of other substances and overloading it with sugar and glycerin and other extraneous materials, but of utilizing its qualities in the most eligible and permanent form, when the plant was in its best condition. Under such methods of investigation and such ideals, the eclectic school has progressed, from the advent of Scudder, for a period of nearly half a century.

COMMERCIALISM.—It will be observed that I have aimed in this record of the American materia medica to restrict my study to influences mainly connected with what is understood as the professional side of life. Excepting the introductory complications in the direction of the pioneer in domestic medication, no reference has been made to what many consider commercialism in medicine. Alas, from beginning to end this has been too great a factor. Had this phase of my subject been incorporated into this paper, an additional chapter, fully as long as the present paper, would have been required. These so-called commercial influences were not abruptly nor yet recently thrown into the field. Upon the contrary, beginning in the earliest days of the therapy of American drugs, we find a dominating influence to be what is known as commercialism but which is very difficult to define. It was linked with the early record, in Massachusetts as well as in Pennsylvania. It was woven into some of the

efforts of conspicuous men, who wrote and copyrighted books, as well as of Samuel Thomson and some of his followers. It touched nearly every phase of professional effort throughout America, continuously pursuing its course under various phases, until about the middle of the last century, when came into play such factors as the manufacturing establishments that in pharmacy wedged themselves into the field of medicine, dominating at last, as can be perceived, many sections in manipulative pharmacy that had previously belonged exclusively to the apothecary. Of these, their influences, methods, and such, we cannot now speak. Let us not forget that in the opening of the present century and the closing of the last came another phase of commercialism in the university methods, chiefly centering in the progressive German institutions of scientific instruction. Needless is it to suggest that these influences have come to be a mighty factor at the present time and that, in the processes now in vogue, wherever patent protection is possible through the opportunities of patent laws, the contrasted attempt Samuel Thomson once made to secure protection by his patent process is insignificant. But as already intimated, these phases of the problem, entering as a thread into the very beginning and at the present time sweeping all before it as in a mighty net, can only be referred to as a subject which must not be overlooked, and cannot rest unmentioned.

WHAT OF THE PRESENT?—Thus we come to the present day. And if this history of the past be correct, we can, through this brief synopsis, form an opinion of the tortuous journey of the American materia medica from its beginning in the day of the Colonial pioneer to the present. In it, as we look back, the men constituting these antagonistic forces were incapable of comprehending the part they were taking in a far-reaching problem, whose end, in connection with the efforts of those to-day involved, is not less surely hidden from us of the present. However, into this problem, which I had hoped to make the substance of this paper, time will not permit me to enter. I must therefore close by remarking that it seems to me, when I revert to what I have said, as though the most interesting phases and side lines connected with the pharmacy (altogether neglected), the educational problems (practically untouched), the hopes, ambitions and antagonisms, the personalities of the parties involved, the many authorities, important as well as seemingly unimportant, unmentioned by me, the forgotten or overlooked ideals of

good men involved in antagonistic directions, these and such as these far overshadow that which I have presented. It has been my aim to present a comprehensive view of the important features or epochs connected with the history and the development of what is known as the American materia medica, as an introduction to that which appeals to me more deeply than does this story of the passing along.

And in this, my closing remark, permit me again to say that the features alluded to in the beginning of this paper, concerning the infinities in, and the opportunities of the American materia medica, as I view that subject and have for years longed to present it, have not as yet been reached.

PHILADELPHIA COLLEGE OF PHARMACY.

MINUTES OF THE QUARTERLY MEETING.

Owing to the delay in transit facilities resulting from the severe snowstorm, the regular quarterly meeting of the College called for December 27, 1909, could not be held for lack of quorum, but five members being in attendance. Adjournment was had to January 4, 1910, when twenty members were in attendance. The President, Howard B. French, presided. The minutes of the semi-annual meeting held September 27, 1909, were read and approved.[1] The minutes of the Board of Trustees for September, October, November, and December were read by the Registrar, J. S. Beetem, and approved.

Mr. George M. Beringer, for the Committee on Centenary Celebration in 1921, presented the following as a tentative scope and plan for consideration:

First.—Scope: That the celebration in 1921 be not only a Centenary Anniversary of the College, but be so broadened as to make it likewise a celebration of the initiatory movement for establishing pharmaceutical education in America, and its subsequent development.

Second.—Plan: That in connection with the anniversary celebration there be arranged an exhibition in the College that shall present the work of this institution, its collection of historical matters and souvenirs, and its

[1] The minutes of the special meeting held December 10 (memorial to Mahlon N. Kline, First Vice-President), were approved.

various collections of botanical and materia medica specimens and apparatus. This feature, it may later be deemed advisable to broaden out into a more extensive exhibit including manufactured pharmaceutical products.

Third.—That there be prepared and published in connection with this Centenary Celebration a historical work covering the progress of pharmacy in America, the history of the Philadelphia College of Pharmacy and of its graduates.

Fourth.—That a standing committee of the College be appointed at once to continue this work, and that in ample time before the Centenary Celebration this committee be enlarged and that it co-operate with similar committees from the alumni association and other organizations if found desirable.

Fifth.—Financial: (This section is reported as amended.) It is apparent that to carry out these plans there will be entailed a heavy expenditure, and in order to provide the necessary funds it is recommended that this committee be empowered to establish an account and solicit subscriptions to pay the expenses of this jubilee meeting and the College contribute thereto the sum of three hundred dollars per annum commencing with the year 1910. It is hereby provided that all moneys contributed and the yearly contribution of the College under this plan shall be paid to the Treasurer of the College and by him kept as a separate account to be known as the Centennial Fund subject to the requisition and use of the special committee to be appointed.

Sixth.—That the alumni be requested to set aside in each monthly issue of the Alumni Report a sufficient number of pages to be used in the continous presentation of the centenary and the historical work of the committee to the graduates of the College.

Seventh.—The details and the perfecting of the plans and arrangements for the celebration, will, of course, develop as the work of the standing committee progresses, and the above is simply submitted as a tentative outline covering the broader principles that should be considered. Signed by the Committee.

(Committee) Joseph P. Remington, Henry Kraemer, Samuel P. Sadtler, M. I. Wilbert, George M. Beringer.

The report was discussed by Messrs. Cliffe, French, Remington, Poley, Sadtler, and Beringer, and after being amended was heartily approved and adopted.

The committee appointed at the meeting held December 10, 1909, to draft suitable resolutions on the death of First Vice-President Mahlon N. Kline, reported by its Chairman, Joseph P. Remington, as follows:

WHEREAS, Mahlon N. Kline, First Vice-President and Chairman of the Board of Trustees, passed from this life November twenty-seventh, nineteen hundred and nine in the full vigor of manhood:

His services to this College since he matriculated in 1868 have been, particularly in late years, constant and of the greatest value.

In public as in private station he was ever aggressive, conscientious, and true, actuated by the highest ideals and a sense of deep responsibility to a Higher Power.

He never swerved from the performance of his duty, and his loss, in the full tide of activity, has come upon us as a severe affliction.

The Philadelphia College of Pharmacy and the Board of Trustees are overcome with grief at the sudden loss which we have sustained, and we tender to his stricken widow and children our heartfelt sympathy.

(Signed) JOSEPH P. REMINGTON,
CLEMENT B. LOWE,
JOSEPH W. ENGLAND.

The report was accepted, and at the suggestion of the President was adopted by a rising vote. It was also agreed that the resolutions be engrossed and a copy sent to the family.

The Secretary was authorized to have a new supply of "Application for Membership with the Code of Ethics" printed, containing the amended requirements for membership.

The President appointed the following members as the Committee on Legislation: Joseph P. Remington, Chairman, M. I. Wilbert, William McIntyre, Warren H. Poley, Theodore Campbell, and Charles Leedom.

Announcement was made of the death of Mahlon N. Kline, J. B. Moore, and Bennett L. Smedley.

The Secretary stated that on account of the death of Mr. Kline, First Vice-President, several certificates of Honorary Membership were lacking his signature, when it was ordered that the Secretary of the College be authorized to fill in the missing signature, appending in a foot-note the reason for so doing.

A letter was read from Mrs. Anna M. Huntington, daughter of Thomas S. Wiegand, acknowledging the receipt of the memorial resolutions and expressing her appreciation of it and of the many and continuous acts of appreciation he had received from the College.

A communication was read from our fellow member Charles G. Dodson, donating to the College a prescription balance that was used in the store of Frederick Brown and which Mr. Wiegand used when as a young man he was employed there.

Our fellow member Joseph A. Heintzelman presented to the Library three volumes on chemistry and pharmacy—one of them edited by Professor Robert P. Thomas, a former professor in the College. The thanks of the College were tendered both the donors.

ABSTRACT FROM MINUTES OF BOARD OF TRUSTEES.

September 7, 1909.—The stated meeting called for this day could not be held for lack of a quorum, and therefore it was decided to call the meeting for September 21, 1909.

September 21, 1909.—Meeting called to order, fourteen members present. The Committee on Examination reported the names of Harmon H. Sechler and Ralph Thomas Ulrich, P.D., as having satisfactorily passed all examination in the Pure Food and Drug Course, and they were therefore entitled to the Certificate of Proficiency, which upon ballot being taken, was awarded to them. Mr. Beringer reported that Mr. J. Redsecker Beetem had kindly consented to continue the *Maisch Pharmacognosy Prize,* under the same conditions as heretofore. He also stated that Mr. Joseph Jacobs, of Atlanta, Ga., proposed presenting annually a prize to be known as the *Maisch Botany Prize,* conditions for awarding same to be arranged for by the Board. These offers were accepted with thanks. Mr. Americus H. Moser, class of 1865, made application for a duplicate diploma, to replace the original, which had been damaged by fire. The request was granted, under the usual conditions. Professor Remington, who had recently returned from the Pacific Coast, reported that the graduates of the Philadelphia College of Pharmacy on the Pacific Coast had formed a branch alumni association, and had arranged to raise $2000 to establish a Pacific Coast Scholarship; and Mr. England supplemented this information by stating that he had already received a subscription towards the fund.

October 5, 1909.—Meeting called to order, with fifteen members present. The Committee on Instruction reported that a special course of fourteen lectures had been arranged for, and requested the members of the Board to give their earnest support to same. A variety of subjects were to be lectured upon, and the speakers would be leaders in their respective branches. The Committee on Scholarships reported the names of nine students who had been awarded scholarships, and, upon vote, their action was confirmed by the Board. The Committee on Examination reported that Jay Dana Beck, John Joseph Bridgeman, Jr., Walter Henry Bronner, Philip Christ Dosch, Charles Duvoisin, Marie Duvoisin, Frank Gannon Ebner, Homer Willis Eakle, Henry Stites Godshall, John Elias Faison Hicks, Vastine Atkinson Keister, John Moser, Jr., Aase

Teisen (Miss.), Frank P. Van Inwegen, Howard Eakle Young had successfully passed their final examinations in the Optional Course in Bacteriology, and were entitled to special certificates of proficiency in said branch. Upon ballot being taken, they were declared eligible to have the certificate awarded them. A communication was received from the Board of Education recommending Robert Gracey, a graduate of the Central Manual Training School, class of 1909, as worthy of a full course scholarship, which on motion was awarded. Mr. Cliffe, on behalf of the class of 1884, presented to the College a barometer, that they had installed in the Chemical Laboratory, for which the thanks of the Board was extended. John Moser, Jr., was elected to associate membership.

November 3, 1909.—The Committee on Scholarships reported that after a competitive examination, Albert Worthington Moore, of Trenton, N. J., and James Vansant Hewitt, of Vineland, N. J., had passed the best examination for admission to the Dobbins Scholarship. The committee, therefore, recommended the awarding of scholarships to both of these men, as the Treasurer reported sufficient funds available to the credit of the scholarship to admit of doing so. Their recommendation was accepted. Professor Remington reported that the Wiegand Scholarship Fund of $3000 was completed by a subscription just received from Samuel Fairchild, of New York. The Secretary was instructed to express to Mr. Fairchild the appreciation of the Board for his contribution. A communication from Miss Sarah L. Naly, class of 1895, requesting the Board to allow the women graduates of the College, who had been students of Dr. Susan Hayhurst, to place in the Museum her portrait, as she was the first woman graduate of the College, was read and the request was granted.

December 7, 1909.—Meeting called to order, with seventeen members present. Upon motion of Professor Remington, it was decided to have the members present sign and call for a special meeting of the College to be held on Friday, December 10, 1909, at ten A.M., to take action on the death of their late Chairman and First Vice-President of the College, Mahlon N. Kline; which motion was agreed to, and on motion of Mr. Poley the Board adjourned until December 14, 1909.

December 14, 1909.—Meeting called to order and fourteen members present. The Committee on Property reported the completion of a hothouse upon the roof of the Annex Laboratory. Committee

on Library reported the presentation of a copy of the Founders' Week Memorial Volume of the scientific institutions, medical colleges and hospitals of Philadelphia, which contained a very interesting and instructive account of the Philadelphia College of Pharmacy. The Committee on Announcement reported the issue of Bulletin No. 2, Volume No. 2. The Committee on Instruction presented a new roster, to go into effect January 3, 1910. By the changes made in same, the number of hours of laboratory instruction was largely increased. A large photograph of the late Thomas S. Wiegand, Librarian of the College, was presented to the College by Mr. Gutekunst, and the thanks of the Board were extended to him for the gift. Frank W. Fluck was elected to active membership.

C. A. WEIDEMANN, M.D.,
Recording Secretary.

JANUARY PHARMACEUTICAL MEETING.

The stated pharmaceutical meeting was held Tuesday, January 18, 1910, at 3 o'clock, with Prof. C. B. Lowe presiding.

Harry E. Sindall, chemist for the Weikel & Smith Spice Co., read a brief paper on the sampling of spices (see p. 80). The paper was discussed by the Chairman, Dr. C. A. Weidemann, Messrs. E. M. Boring, Warren H. Poley, and others. In reply to questions which arose during the discussion, Mr. Sindall stated that the improved mills for the grinding of spices, including ginger and capsicum, are constructed in such a manner as to prevent the escape of the very fine material, and thus of excessive irritation of the respiratory tract, the effects generally not being noticeable after the first day; that there is not much adulteration of spices in those States having food laws, as in Pennsylvania, but in those States having no food laws, as in Maryland, there is considerable sophistication; and that one of the most common examples of sophistication is that furnished by ground ginger, the method being to add capsicum to ginger which has been previously partly exhausted for other purposes.

John K. Thum, apothecary at the German Hospital, Philadelphia, read a paper giving abstracts of the Researches of the Pharmaceutical Institute of the University of Berlin for 1908, which will be published in a later issue of this JOURNAL. The paper elicited queries and comments from Professor Lowe, and Drs. Weidemann and Osterlund.

Prof. Henry Kraemer called attention to some of the features of the third and latest edition of the Pharmacopœia of Japan, stating that inasmuch as the revision of our own Pharmacopœia is being considered from so many points of view, a more intimate knowledge of the various foreign pharmacopœias is desirable. He stated that the Japanese Pharmacopœia is issued by an edict of the Government, that it is a very practical and well-arranged work, and is essentially a pharmacist's book.

Among the features to which he particularly referred are the following: The aromatic waters are mostly made directly from the drug by distillation; extracts, tinctures, and wines are made by maceration; sesame oil is directed in the formulæ for ammonia liniment and lime liniment; formulæ are given for the preparation of medicated cottons and gauzes (telæ); in addition to antidiphtheric serum, antitetanic serum and tuberculin are official; besides the ferments, pepsin and pancreatin, diastase is official; to the assay processes identity tests for the alkaloids are usually appended; the descriptions for vegetable drugs are very simple in some cases, as that for licorice root, but when the drug requires special consideration the description is given in more detail. Of the vegetable drugs the following were mentioned as of special interest: scopolia preparations replace those of belladonna, although belladonna leaves are official; under ipecac directions are given for removing the wood before using the drug in the making of preparations; three starches are official, that derived from the potato tuber, one from the root of *Erythronium dens canis* L. and one from the root of *Pueraria thunbergiana* Benth. Other of the official drugs were also mentioned, as follows: the rhizome (root) of *Phytolacca acinosa var. esculenta,* the whole plant of *Taraxacum officinale var. glaucescens,* the rhizome of *Coptis anemonæfolia* and of other species of Coptis, the rhizome and roots of *Gentiana scabra var. Buergeri,* the wood of *Picrasma quassioides,* the seed of *Prunus armeniaca,* and the leaves of *Prunus macrophylla.* Another noticeable feature is the number of American and European drugs which are recognized, as the tuberous root of *Aconitum Napellus,* cascara sagrada, and hydrastis. Among the official alkaloids, agaricine was noted.

The terms and general directions used throughout the text are explained in the preface; the metric system is used, and quantities given in the formulæ are in parts by weight. In the appendices

are given a list of the common official medicines which should always be kept in every dispensary; a list of the official medicines which belong to the class of poisonous medicines, which should be kept with special care and separated from others; a list of the official medicines that belong to the class of strong or energetic medicines, and which also should be kept with care separated from others; and a list of medicines together with their doses for an adult.

In commenting on some of the features to which Professor Kraemer called attention, Prof. I. V. S. Stanislaus said that he thought it rather remarkable that antitetanic serum and tuberculin should have been made official in the Japanese Pharmacopœia when they are used so little in practice as curative agents. With regard to the preparation of aromatic waters, he said that, generally speaking, the oil does not represent the drug or contain all of the odorous principles, as in the case of oil of rose where the benzene alcohol, one of the constituents which gives to rose its peculiar odor, does not come over with the distillate.

Mr. Thum expressed the opinion that medicated gauzes should be admitted to the U. S. Pharmacopœia, and stated that the official standards for ether are not sufficient to insure an ether of proper strength and purity for anæsthesia. He said that the best ether on the market varies, and that the next edition should recognize an ether for anæsthesia, the standards for which should be very high regardless of cost, although he thought that ether could be manufactured more cheaply now than formerly. Remarks were also made by Professor Lowe and Messrs. Boring and Poley.

FLORENCE YAPLE.
Secretary *pro tem.*